

# 1 EXECUTIVE SUMMARY AND CONTEXT

This is the December 16, 2021 overview of modelling studies conducted and collated by the PHAC Modelling Group. Summaries below are hyperlinked to the related section of the report for full details.

## CURRENT SITUATIONAL AWARENESS

### Domestic

*The effective reproduction number ( $R_t$ )* for Canada as of December 4, 2021, estimated using date of illness onset, was 1.04. Nationally,  $R_t$  was below 1 at mid-September, but has been increasing. On December 4,  $R_t$  was above 1 in Ontario and Quebec, at 1 in Manitoba and it remains below 1 in British Columbia, Alberta and Saskatchewan.

*The short-range statistical forecast* for Canada up to December 23, 2021 is:

- 1,885,777 cumulative cases (range: 1,879,129 to 1,892,271); and
- 30,141 cumulative deaths (range 30,045 to 30,236) by that date.

On average, case incidence is projected to increase over the next week in Canada. Mean case incidence is projected to increase throughout the projection period in all provinces except for Saskatchewan. The incidence of new deaths is projected to remain stable in Canada.

*The long-range dynamic modelling forecast (Simon Fraser University model)* for Canada suggests the trajectory is towards an Omicron-driven resurgence over the coming months, with ~20,000 daily cases by early January, assuming current contact rates. If contact rates remain at the current level, a rapid Omicron-driven resurgence is forecast for all provinces.

*The long-range dynamic modelling forecast (PHAC-McMaster University model)* suggests that nationally, the trajectory is towards a resurgence with more than 40,000 daily cases by the end of December, assuming current contact rates. If contact rates remain at the current level, a resurgence is forecast for all provinces with Omicron.

### International

*Importation risk modelling* for the week of December 5 to 11, 2021 suggests that an estimated 3,251 people with COVID-19 came to Canada including 1,171 air travellers, primarily from the United States of America (USA), Mexico, and the Dominican Republic and 859 land travellers from the USA. From December 5 to 11, 2021, the estimated percentages of imported cases from air travel that may be variants of concern or variants of interest are 97.03% B.1.617.2 (Delta), 1.82% for AY.4.2 (Delta), 0.24% for B.1.1.529 (Omicron) and 0.03 % for B.1.621 (Mu).

*Assessment of the impact of interventions* on the COVID-19 epidemic in Canada and other countries using the Oxford University stringency index:

# PHAC Modelling Group Report

- Since early December 2021, the stringency index in Canada has decreased to a current value of 63, even though cases increased during the same period.
- Experiences in several countries suggest that swift re-implementation of public health measures may be needed as evolving virus strains (particularly emerging Omicron variant) and pockets of vulnerable populations lead to resurgence.

## DYNAMIC MODELLING

*The PHAC agent-based model (ABM)* explored the impact of booster administration and shutdowns on the emerging Omicron situation in Canada. In the simulations, accelerating booster administrations to those aged 18+ was insufficient on its own to prevent healthcare capacity from being overwhelmed in the upcoming months. Findings suggested that an Omicron-driven resurgence will likely require the reintroduction of more stringent measures to prevent a surge in hospitalisation and deaths

*The PHAC compartment model* explored the impact that Omicron may have on cases and health care in Canada, and what public health measures, such as booster vaccinations, might be used to reduce the burden of this new variant of concern. Results suggest that the higher transmissibility and vaccine escape of the Omicron variant may result in a very large increase in cases and hospitalisations in early 2022. Model scenarios suggest that booster vaccination alone, starting as early as mid-December may not be sufficient to control the epidemic and keep hospitalisations at levels equal to, or less than, previous waves. However, the accelerated implementation of boosters, combined with increased stringency measures could limit daily hospitalisation to those in previous waves, as long as Omicron has lower virulence than previous strains.

*The wastewater epidemic model* incorporates both clinical and wastewater data to produce estimates of the effective reproduction number  $R_t$ . The results suggest that wastewater data can support, and even substitute, traditional surveillance data. Wastewater and case surveillance have different sources of biases, and triangulation of those two data streams may allow a better assessment of the state of the epidemic in each location. In addition, wastewater data suggest that  $R_t$  calculated from reported cases may under-estimate the real impact of the mass vaccination rollout in Canada.